Mr. Boulenger. Already a lavishly illustrated quarto volume ("Annales du Musée du Congo") had been issued containing descriptions and figures, by the same author, of new genera and species of fishes recently discovered in the Congo, and now comes the present work, the twenty-five plates of which are "half-tone" reproductions of the lithographs illustrating the descriptions in the "Annales."

This is the first work dealing with a group of animals over the whole extent of the Congo Basin, *i.e.* including Lake Tanganyika. It commences with an introduction divided into six parts, namely, (1) general characters of the fresh-water fishes of Africa, (2) distribution of fishes in the Congo Basin, (3) fisheries and methods of capture, (4) methods of preservation and transport of fishes for scientific purposes, (5) terminology used in scientific descriptions of fishes, (6) list of previous writings specially dealing with the fishes of the Congo Basin.

A few years ago, about 90 species of fishes were known from the Congo Basin, but in the present work the list is swelled to no less than 320, 78 of which are confined to Lake Tanganyika. The families most abundantly represented are Mormyridæ, Characinidæ, Siluridæ and Cichlidæ, the name for the last-mentioned family being for good reasons adopted in place of the better-known "Chromidæ."

I am glad to see that, in spite of Cope's dictum, Mr. Boulenger still considers the Lampreys to be "fishes," as he divides the class into three subclasses—Cyclostomi, Chondropterygii and Teleostomi. Only the last is represented in the fish-fauna of the Congo Basin.

The Teleostomi include here the Crossopterygii, the Dipneusti (the usual name "Dipnoi" is rejected on account of its having been originally used to designate the Batrachia) and the Teleostei. Our author seems inclined to retain the "Ganoids" (= Acipenseroidei and Lepidosteoidei) as a distinct order, but as none of these inhabit the basin of the Congo, the question is not gone into in a detailed manner. As to the Crossopterygii, Mr. Boulenger admits only two primary divisions, the extinct Osteolepida and the modern Cladistia, represented in African rivers by the singular though well-known family Polypteridæ, of which five species of Polypterus, three being new additions, and one of Calamichthys are here chronicled. As regards the Dipneusti, in the course of some interesting remarks on vertebrate limb theories, the author adopts Dollo's view as to their probable derivation from the Crossopterygii, the corollary to which, as the present writer has also pointed out, is that the "archipterygial" form of limb must have been diphyletically realised, on the one hand, by the Pleuracanthid Selachii, and on the other by the Holoptychii and the lung-fishes. An interesting new species of Protopterus (*P. Dolloi*) is here described and figured.

Proceeding to the ordinary bony fishes or "Teleostei," we may note in the first suborder, that of the Malacopterygii, the extraordinary variety of form among the Mormyridæ, even within the limits of one genus, as in the case of *Mormyrops curtus* and *M. attenuatus* (plate iii). Sagemahl is followed in the association of the four families of Characinidæ, Cyprinidæ, Siluridæ and Gymnotidæ in one group or suborder of Ostariophysi, the essential characteristic of which is the presence of the Weberian ossicles, by which the swim bladder is brought into relation with the ear. The Cyprinodonts, of which the region produces four species all belonging to the genus Haplochilus, are included with the Esocidæ, Dalliidæ and Amblyopsidæ in a third suborder, that of the Haplomi. A fourth is formed by the Percesoces (the Müllerian "Pharyngognathi" being entirely abandoned), and which includes, not merely the Scomberesocidæ, but also the Ammodytidæ, Atherinidæ, Mugilidæ, Polynemidæ, Sphyrænidæ, Ophiocephalidæ and Anabantidæ. Coming now to the fifth suborder of Teleostei, that of the Acanthopterygii, we find that, with the exception of a few Serranidæ, Sciænidæ and Pristipomatidæ, it is entirely represented by twenty-four genera and eighty-seven species of one family, that of the Cichlidæ (= Chromidæ of Günther). This family, which was also included in the "Pharyngognathi" of the Müllerian system, is here considered as closely allied to the Perches, in spite of the fusion of the inferior pharyngeal bones. The diversity of genera of this family in Lake Tanganyika is worthy of notice. The volume finishes with a description of eleven species of Mastacembelus (suborder Opisthomi) and one of Tetrodon (suborder Plectognathi).

In conclusion, it may be said that the talented author is to be congratulated on the interesting work he has produced, and the zoological public in having, in so compact a form, a guide to a general knowledge of the fresh-water fish-fauna of so large a portion of the African continent, interspersed with many valuable remarks bearing on the subject from a morphological as well as systematic standpoint. R. H. T.

APPLIED MECHANICS.

The Roorkee Manual of Applied Mechanics, Stability of Structures, and the Graphic Determination of Lines of Resistance. Vol. ii. By Lieut.-Colonel J. H. C. Harrison, C.E., late Assistant Principal, Thomason Civil Engineering College, Roorkee. Pp. viii+318 +70. (Roorkee: Printed at Thomason Civil Engineering College Press.)

THIS "Manual of Applied Mechanics" is primarily intended for the use of students of the Thomason Civil Engineering College, Roorkee, North-West Provinces, India. It forms an extension of vol. i.; the latter was originally prepared by Lieut.-Colonel A. Cunningham, R.E., and was revised by the present author in 1895.

Vol. i. does not include important subjects such as the stability of block-work, the design of retaining walls, abutments, masonry arches, earthwork, foundations, &c. These omissions have been met by the issue of vol. ii. Moreover, the treatment in vol. i. is mainly analytical, whereas in vol. ii. graphical methods have been developed and largely employed; so that the two volumes together now form a very complete treatise on the principles of mechanics as applied to roofs, girders, bridges, foundations and allied structures.

In the first part of the volume under review the author describes the plotting of vector and link polygons for a general system of forces in one plane. Then, in reference to various types of structures, such as beams, cantilevers, block-work, suspension chains, and arches he develops

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the properties of these polygons and shows how, by their use, the shearing and bending actions, lines of resistance, &c., due to given loads may be determined. The drawing of link polygons so as to lie within given loaded arch rings is explained, and applied to the determination of the so-called line of least resistance of a masonry arch. The deflections of beams are next considered, and the link polygon method is extended and applied to the plotting of the elastic curves of loaded beams, including continuous beams. The latter were treated in vol. i. by the aid of the theorem of three moments. The student has thus the advantage of a comparison of the two methods.

Nearly a fourth part of the text is thus occupied in establishing the fundamental properties of the link and vector polygons, and then the author, in the second part, which comprises the remainder of the work, and is divided into three sections, proceeds to the practical applications.

Section i. deals with the stability and design of tall chimneys, buttresses, and various forms of cranes.

In Section ii. the subject of earth pressure is very fully considered, and examples are given of the design of retaining walls to resist the pressure of earth, and of masonry dams for reservoirs.

"Structures that span an interval" is the heading to the concluding Section iii.; and here the author treats very fully of masonry arches, fixed and continuous girders, cantilever bridges, stiffened suspension bridges, hinged metal arches, &c.

In an appendix a partial reprint is given of a paper by Colonel A. Cunningham on well foundations, which should prove of special interest to students and engineers in India, where, in spanning many of the rivers, the foundations have to be laid in quicksand.

It seems an unfortunate omission that in so excellent a treatise no reference is made to the application of the strain-energy method and the principle of least work to calculations on the deflections and stresses in braced frames, structures with redundant members, arched ribs, &c.; but otherwise the treatment is quite up to date. As regards practical construction, information is given as to the design of many details; and some examples of complete designs are fully worked out, and illustrated by drawings, taken principally, by permission, from Colonels Wray and Seddon's "Instruction in Construction." There are numerous folding plates, facilitating reference and allowing the figures to be drawn to a large scale.

The treatise can be recommended as a useful book of reference for engineers in the pursuit of their profession. Students who master the details of both volumes should, in the subjects of which they treat, be well equipped for their duties of after life.

OUR BOOK SHELF.

Ordnance Survey of England and Wales. Scale 4 miles to 1 inch, or 1 : 253,440. Sheet iv. Price 1*s.* 6*d.*

THIS sheet is a specimen of the new quarter-inch map of the British Isles which is being issued by the Ordnance Survey at Southampton, and we have pleasure in recognising in it many marks of the vitality of the Survey and of its power of employing the most modern methods to meet new requirements. The old quarter-inch map of Ireland in four huge sheets was a masterpiece of engraving and of printing directly from the plate; the old quarter-inch map of Scotland was a somewhat hapless attempt to show rivers in blue on an outline very sketchily printed from transfers in black, while the old quarter-inch map of England was a clear outline with fine lettering but little detail, the antiquity of which was thrown into painful relief by the insertion of railways up to a modern date. The new quarter-inch map of Great Britain, now in course of publication, is up to date in all particulars, and beautiful as well as accurate. The sheets are of convenient size (24 in. × 16 in.), the edges graduated to single minutes of latitude and longitude, with the meridians and parallels for each 20′ drawn clearly across the map, thus greatly facilitating the plotting of any distribution which has been worked out on maps of a larger scale, an advantage which will appeal to every geographical worker. The names and general detail are printed in black, the size of the lettering nicely graduated to show relative importance, and the style of execution is worthy of the best traditions of the old one-inch map. Railways are shown in a strong black line, county boundaries in a distinct dotted line, and roads of three classes are distinguished, the first class having the usual indication as to fencing and being coloured solid brown. Rivers and other water surfaces are given in blue, and when the altitudes marked on in bold black figures are considered the surface would appear to be so fully occupied that nothing could be added. Here, however, the chief novelty and beauty of the map appears. The configuration of the country is shown by a hill shading so expressive and unobtrusive that it actually seems to make more room for the other features, by throwing each into its own proper place and fixing it there. The blue threads of the water-courses accentuate the valleys of the high moorlands, the roads and railways are fitted with a pictorial commentary explanatory of every curve; even the county boundaries, so arbitrary on common maps, are seen to be natural lines, now a main watershed, again a powerful river. Colonel Johnston deserves the utmost credit for his bold and successful experiment in expressing relief without the use of contours or of hachures by the half-tone photographic reproduction of washes of colour. The hill-work is printed in brown, with which the blue of the water and the black of the names and railways contrast equally, and even the green with which extensive woodlands are shown stands out well.

The technical production leaves nothing to be desired, and we confidently place this map before any other in the world on the same scale for beauty of finish, accuracy of execution and sound judgment in the selection of features and names. It will be invaluable for mapping the distribution of phenomena in many branches of science, and welcome also to the tourist and motorist.

A Manual of Elementary Practical Physics. By Julius Hortvet, B.S. Second edition. (Minneapolis: H. W. Wilson, 1902.)

"LIFE is not long enough to admit of a *rediscovery* of the fundamental laws of physics. Besides . . . some of the laws were not discovered through experiment at all, but, on the contrary, were obtained by pure reasoning and afterwards verified by experiment."

This quotation will show that the author is not an adherent of the out-and-out heuristic school. But while it is not expected that a pupil shall go through the necessarily slow process of acquiring *all* his knowledge by his own investigations, he is expected to think for himself while the chain of reasoning to be followed and the conclusions to be drawn are indicated by questions which the pupil has to answer. While in sympathy, in the main, with this method, we do not think that the questions are always very happily chosen. Thus after experiments on the bending of a lath and the stretching

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